Wind Energy and Society

Hard Bop and Cool Jazz

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Wind Energy and Society: Hard Bop and Cool Jazz

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June 25, 2014

OUTLINE

- My education & work experience
- Lessons learned from wind energy (2001-present)
- Recent research topics
- What I hope to accomplish at DTU?

Bonnie Ram

- Family Roots in Montreal, Canada and Miami, FL
- Clark University, M.A.
- Groundwater contamination & legal frameworks (thesis)
- Development & natural resources, Energy planning
- Beijer Institute (Swedish Academy of Sciences) – Zimbabwe (book series)
- WRI – Policy & environmental research on sub-Saharan Africa
- FAS Fellowship – campaign to stop plutonium production for weapons
- Moved to consulting world: federal government agencies- Department of Energy
  - EIA and consent processes
  - Nuclear waste management
  - Public engagement

Bonnie Ram

- Consulting firms 20+ yrs.
- 2001-2010. NREL & the DOE's Office of Wind & Hydropower Technologies
- Environmental and social sciences & regulatory frameworks related to land-based and offshore wind energy, wave & tidal power

- NREL's Large Scale Offshore Wind Power in the U.S: Assessment of Opportunities and Barriers (with W. Musial)
- DOE's 20 Percent Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply (co-manager)
- An Integrated Risk Framework for Gigawatt Scale Deployment of Renewable Energy (author)
- IEA Offshore Wind Annex (2004)

Bonnie Ram

- University of Delaware – Sr. Research Scientist
- Associate Director, Center for Carbon-free Power Integration
- 4 winning DOE grants (offshore wind)
- Won National Science Foundation grant - Risk and uncertainty analyses for offshore wind siting
- Ram Power, L.L.C.
- Formed new Mid-Atlantic stakeholder wind coalition
- Strategic planning for regional marine spatial planning
- Chair of AWEA R&D Subcommittee on Offshore Wind
- Co-authored 2 articles – energy transformation

What have I learned?

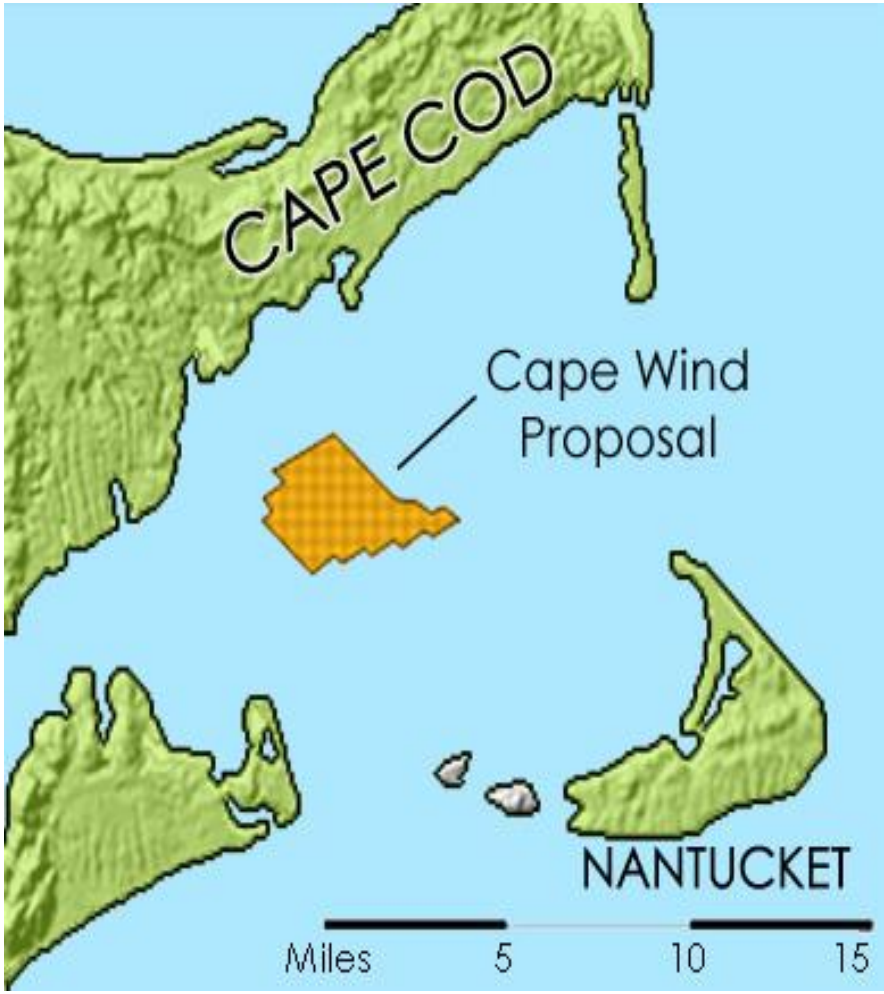
- Importance of mentors & colleagues
- Broad learning leads to interdisciplinary views
- Decisions are local ultimately
- DC is an amazing laboratory for national policy making
- We work too many hours in Washington, DC
- One horse town!
- Great jazz clubs! www.twinsjazz.com
- http://www.bohemiancaverns.

OUTLINE

- My education & work experience
- **Lessons learned from wind energy, wave/tidal power (2001-present)**
- Recent research topics
- What I hope to accomplish at DTU?

How it all began……Cape Wind Nantucket Sound

- First permit filed (2001)
- 130 turbines – about 468 MW
- About 24 square miles
- MET tower installed (2002)
- Draft EIS - Nov. 2004
- Well-funded and high profile opposition



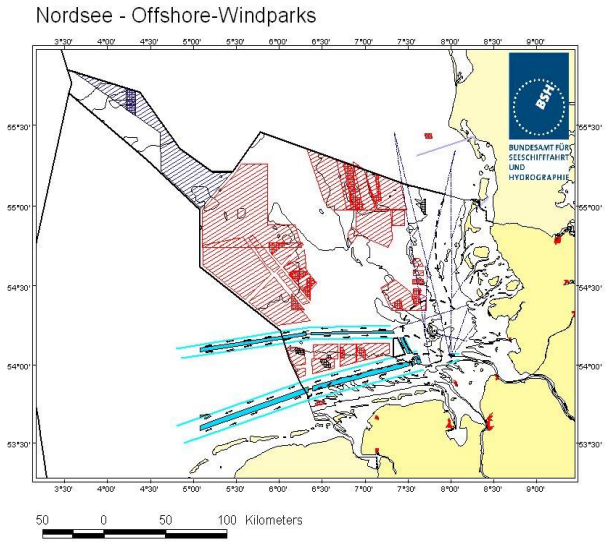
Cape Wind Lessons Learned

- Institutional changes with regulatory agencies
- Need third party, credible scientific information
  - Incorporate EU findings
- More information does not create public support or trust
  - Public opinion is evolving
  - Discuss in public forum before siting decisions are made
- Collaborative siting process is needed

179 feet installed at Horseshoe Shoal

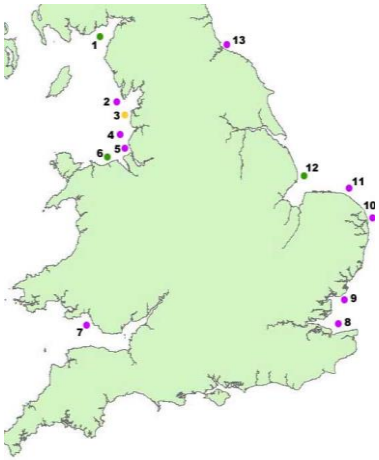
Europeans are Planning on a National Scale

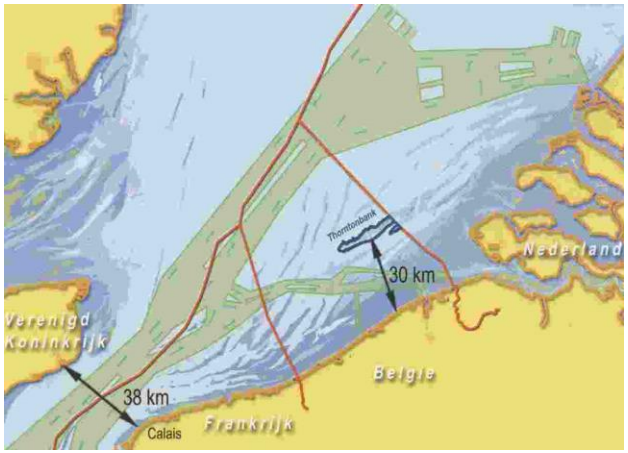
Germany



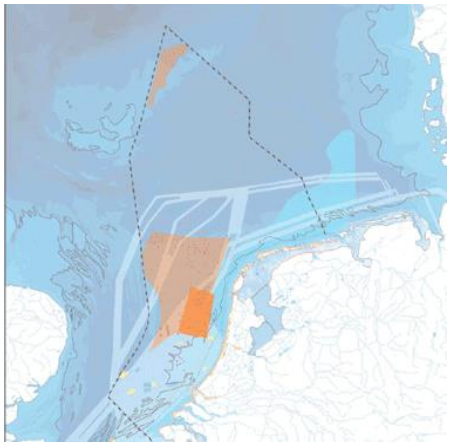
Denmark

Great Britain





Belgium



Netherlands

Source: Jos Beurskens, ECN

Environmental Risks & Benefits (physical/biological)

- Seabed sediments
- Scour pits
- Riparian and coastal processes
- Seabed contamination
- Water and air quality
- Protected sites and species
- Benthic ecology
- Fish and shellfish/ Fisheries
- Birds
- Marine mammals and bats
- Cables and pipelines
- Military activities
- Disposal areas
- Electronic and magnetic fields
- Onshore grid connection
- Noise and vibrations
- Cumulative risks
- Climate change
- Decommissioning

Human Risks & Benefits

- Worker health and safety
- Integrity of shoreline communities
- Tourism and recreation
- Aesthetics
- Cultural/historic views
- Property values
- Conflicting uses/accidents
- Shipping and navigation
- Noise
- Radar/radio disturbances (military/commercial uses)
- Transmission lines
- Electromagnetic fields
- Marine archaeology
- Cumulative risks (e.g., air quality)

It's Not One Type of Risk and Its Many Sites

Land-based Examples

- Raptors in California - Eagles
- Bats in the East
- Military radar across sites
- Transmission siting & land uses
- Mountaintops and visual
- Noise and sound impacts
- Property values
- Sense of place and community

It's Not One Type of Risk and It's Many Sites

Offshore Wind Examples

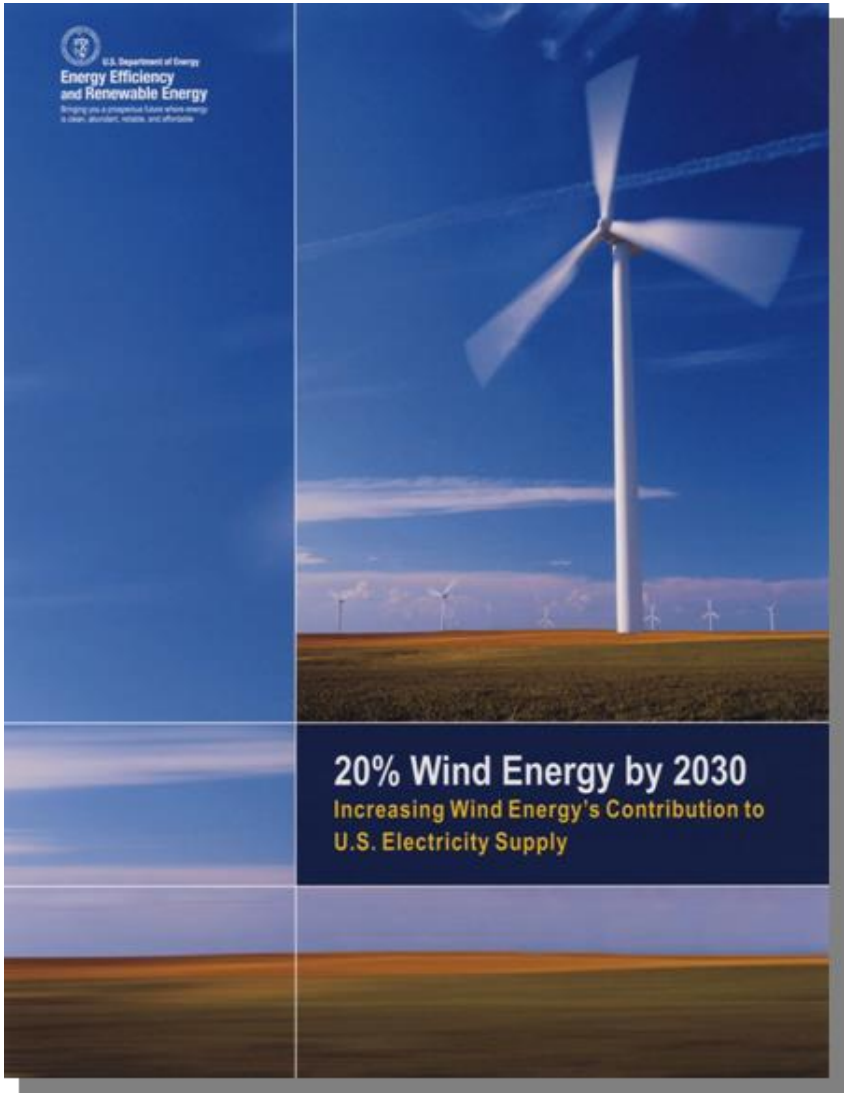
- East Coasts – recreation & beach tourism
- Eastern shore – migratory birds
- Endangered species – turtles, fish,
- SE to NE regions – right whale migration
- Viewshed across all sites
- EMFs from subsea cables
- Marine spatial planning & tourism
- Fishing restrictions – commercial/recreational
- Ship collisions

Technology Challenges

Technology/ Risks/Effects	Public Concerns/Values	Coastal/ Land Uses (compatibility/ conflict)	Visibility & Aesthetics	Habitat/ Wildlife	Regulatory Framework (consents/EIAs)
Ocean, wave, tidal	X	X	X	X	X
Wind	X	X	X	X	
Solar-CSP		X	X	X	
Biomass	X	X	X	X	X

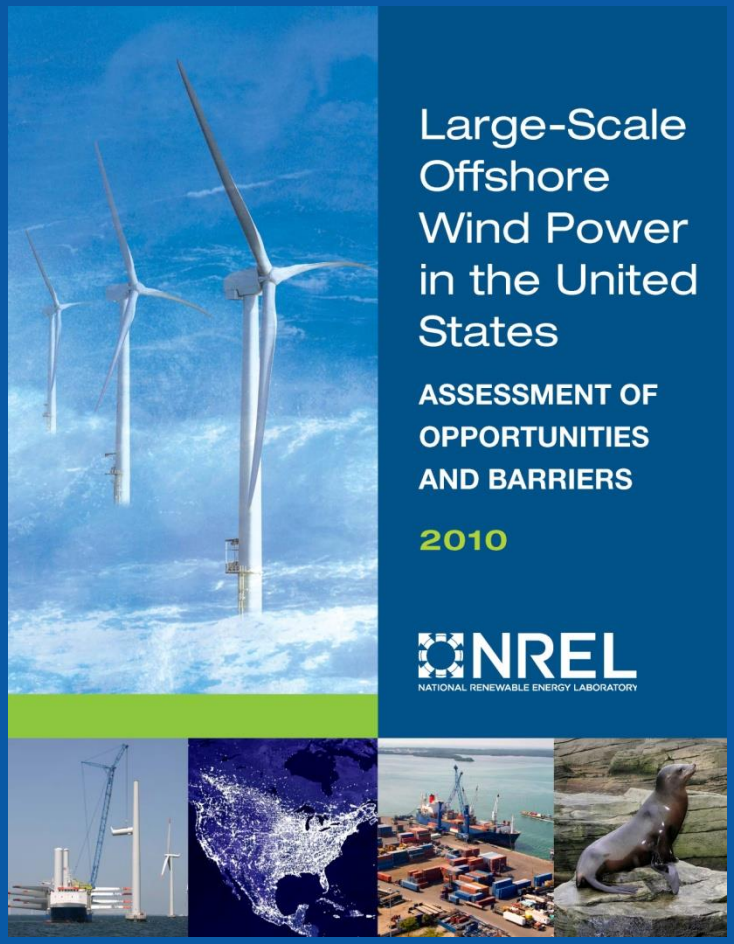
20% Report – 300 GW by 2030

- ✓ 20% wind electricity would require about 300 GW of wind generation
- ✓ Affordable & available across the country
- ✓ Cost to integrate wind modest
- ✓ Emissions reductions and water savings
- ✓ Transmission a challenge



NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Large Scale Offshore Wind Power in the United States: Assessment of Opportunities and Barriers



http://www.nrel.gov/docs/fy10osti/40745.pdf (PDF 7.1 MB)

Authors: Walter Musial (NREL) and Bonnie Ram (Energetics)

OUTLINE

- My education & work experience
- Lessons learned from wind energy (2001-present)
- **Recent research topics**
- What I hope to accomplish at DTU?

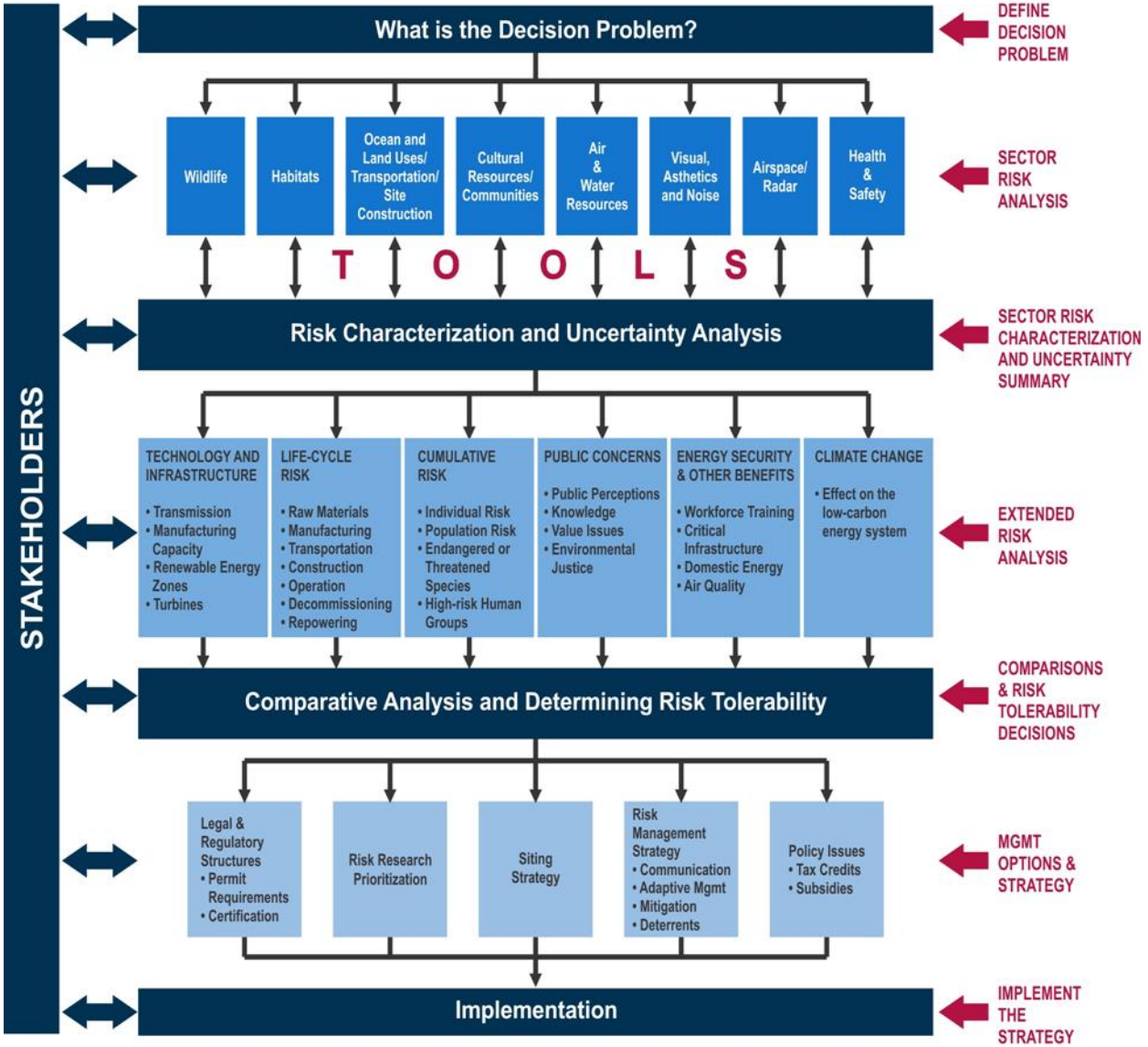
Are we asking the right questions about fish and wildlife?

- Assuming specific sectoral "impacts" (e.g., fish & wildlife) are most important in a complex decision making problem across many sites

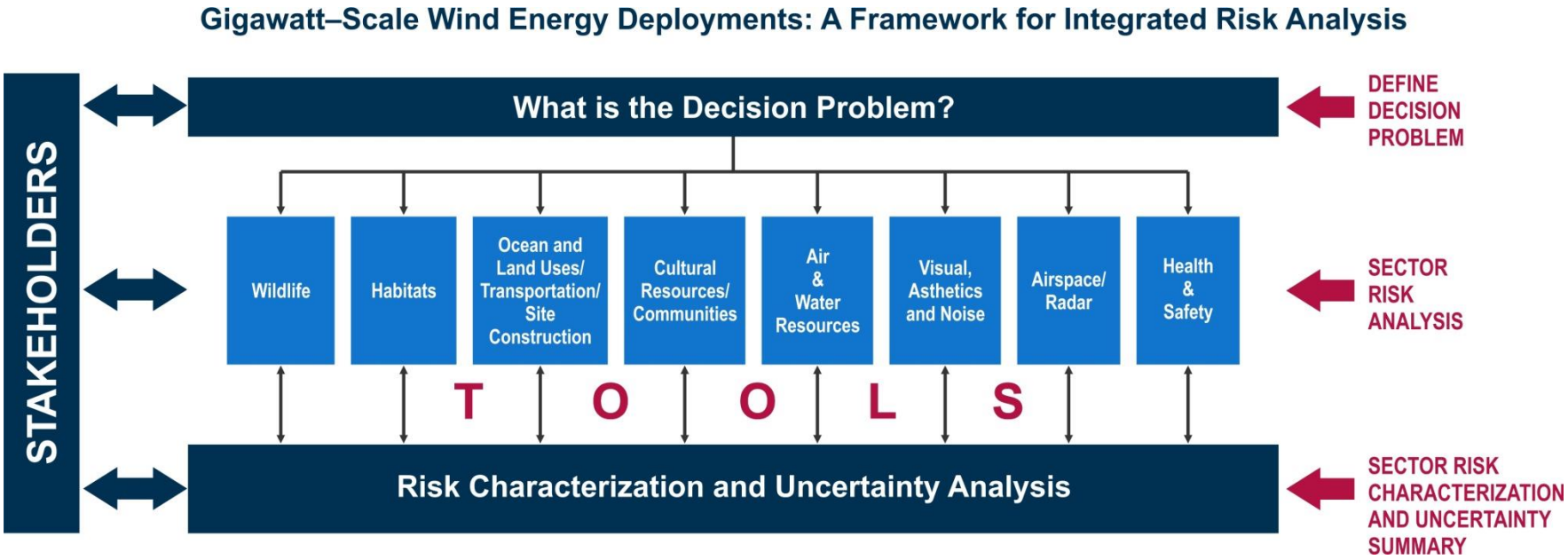
IMPACTS ≠ **RISKS**

What have we learned in 20 yrs?

Gigawatts–Scale Wind Energy Deployments: A Framework for Integrated Risk Analysis

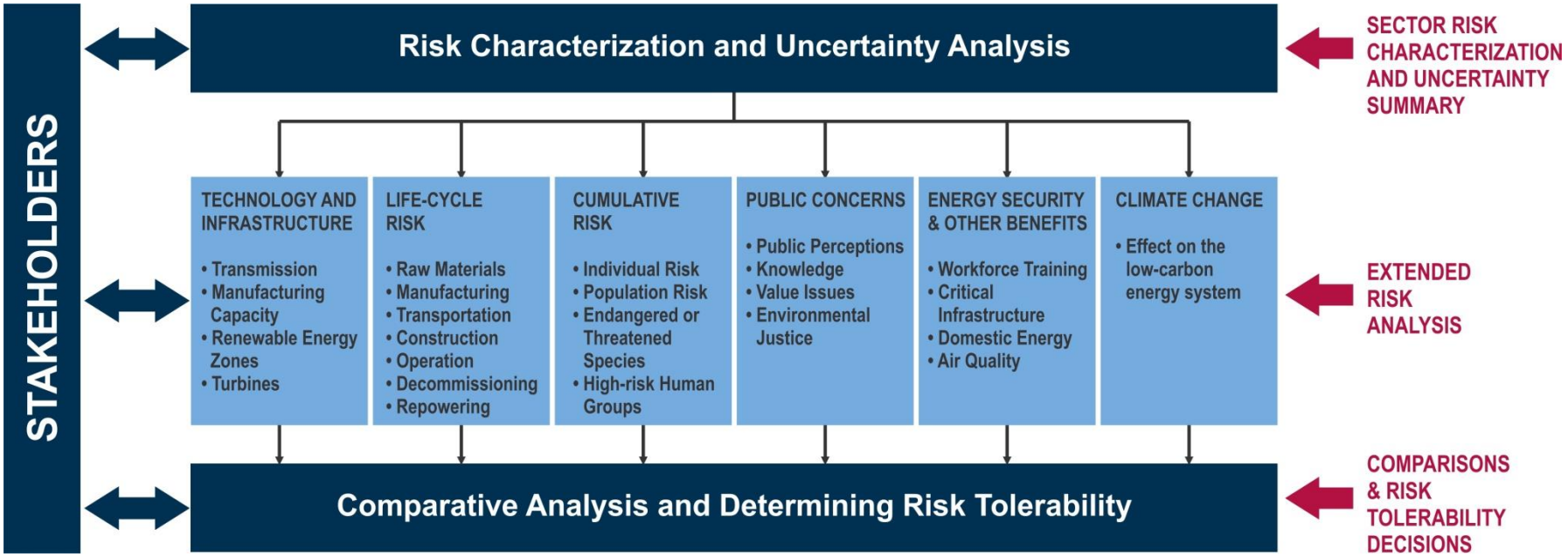


Risk Characterization (top)

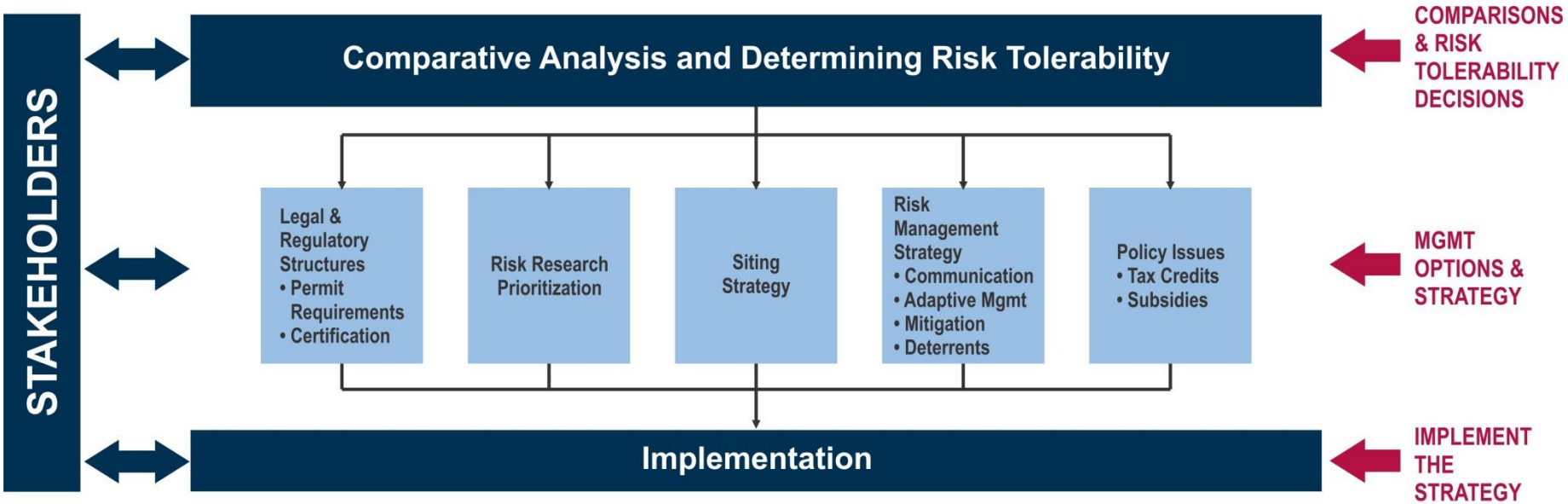


Reference citations: "An Integrated Risk Framework for Gigawatt Scale Deployment of Renewable Energy: The Wind Energy Case Study," April 2010. NREL Subcontractor Report (2009). NREL/SR-500-47129.
http://www.nrel.gov/docs/fy10osti/47129.pdf

Determining Risk Tolerability (middle)



Management Options (bottom)

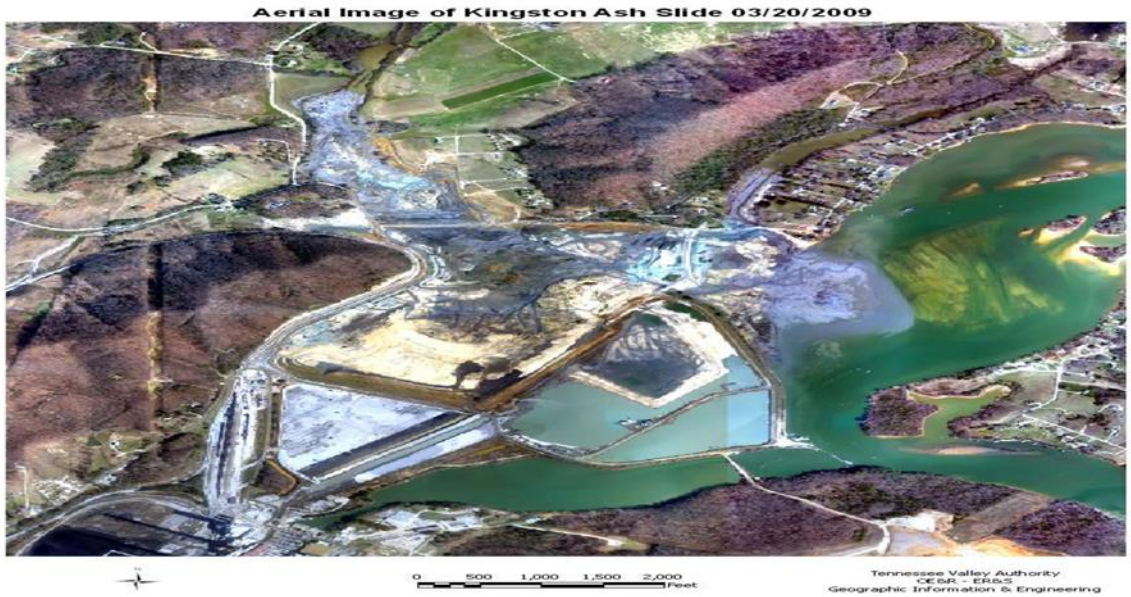


Energy Transformation: "Systemic" Approach, not Piecemeal

- *Technology Innovation*
- *Cost of Energy*
- *Biological & Physical Effects*
- *Transmission Planning*
- **Social – Technical System (what gets left out)**
  - Political = Institutions and Governance
  - Cultural Beliefs and Public Values (Context)
  - Human Behaviors
  - Energy Policies
  - Ecosystem Services and Natural Capital
  - Macroeconomics and Subsidy Systems

Major Impediments to Transformation

- Lock-in Infrastructure
- Life Cycle Costs & Subsidies
- Public Values
- Social Trust & Social Capital
- Short-term Political Goals



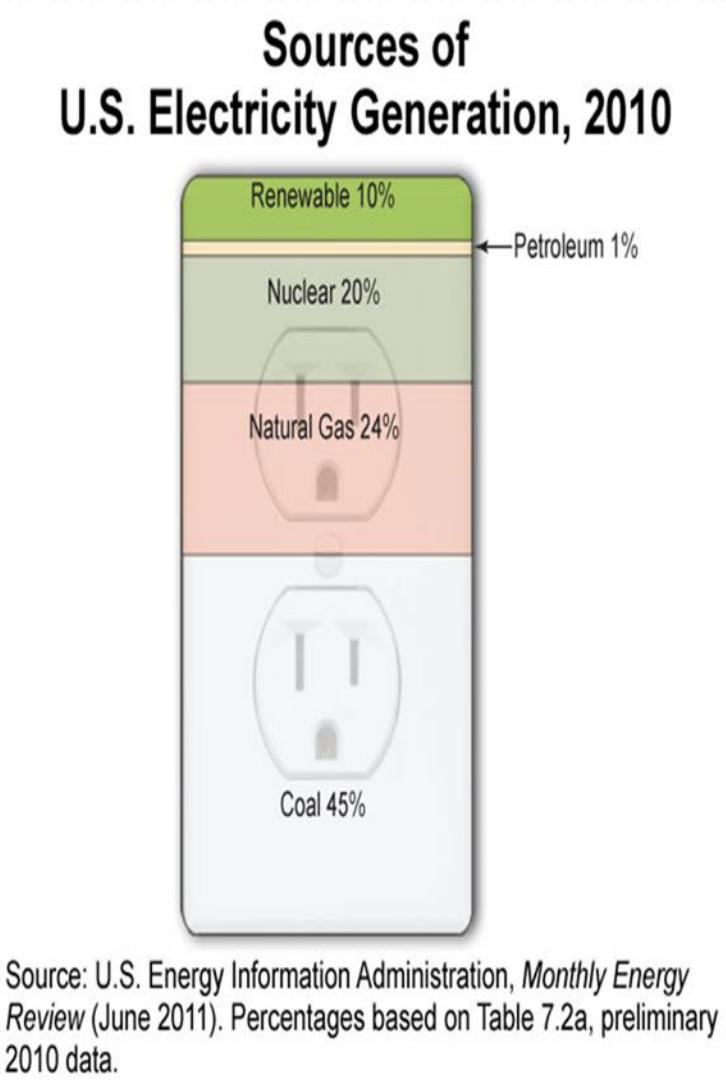
Aerial Image of Kingston Coal Ash Slide: 5.4 cubic yards of toxic sludge in 2009

OUTLINE

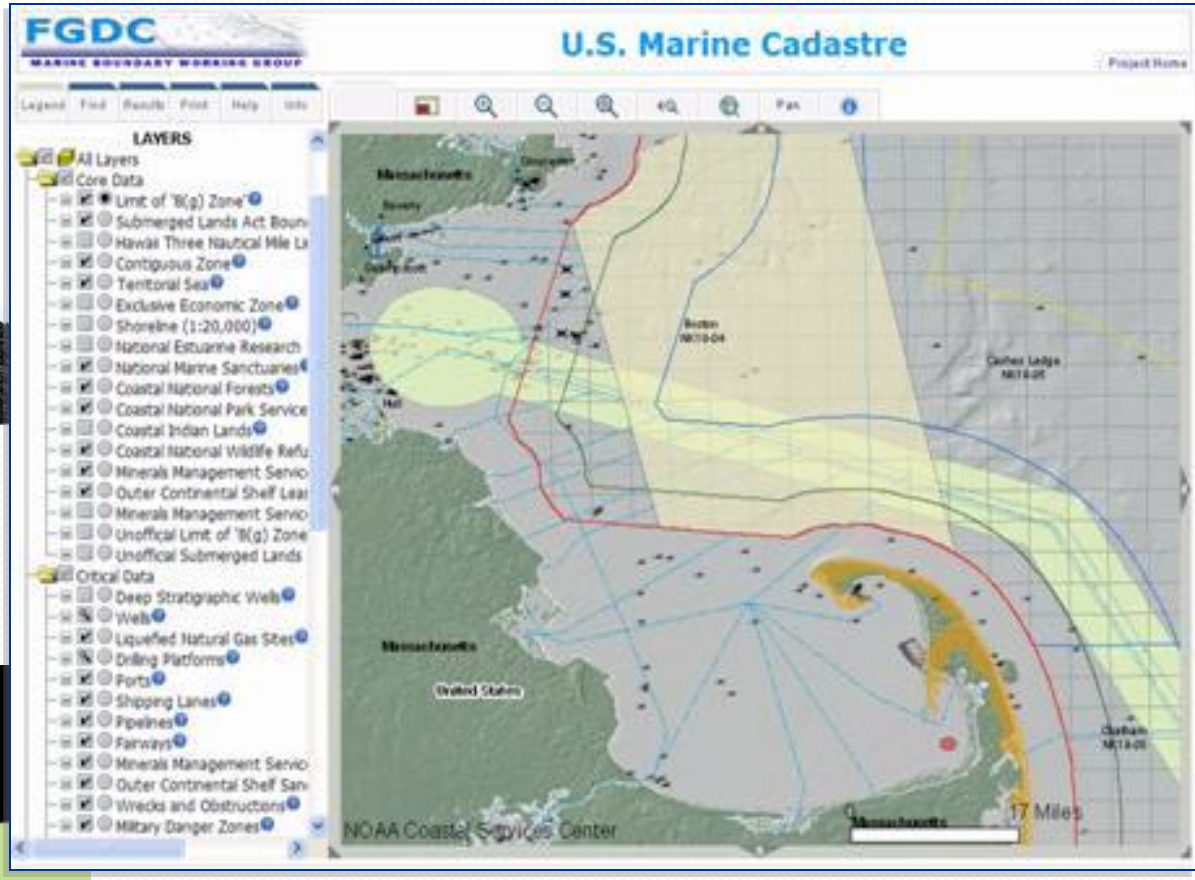
- My education & work experience
- Lessons learned from wind energy (2001-present)
- Recent research topics
- **My wind energy & society footprint at DTU?**

The Argument

- Rapid & sustained energy transformation with large-scale wind requires a new paradigm
- Success will depend on:
  - Systemic thinking
  - Training an interdisciplinary generation
  - Prepare for surprises
  - Process issues early on with stakeholders

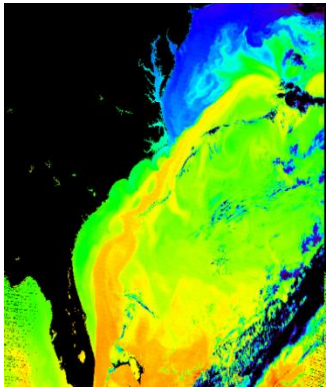


Grand Challenges are "Process Issues" = Social Sciences



Process Issues: Public Values

- Distribution of benefits and risks
  - Transmission lines!
- Value issues
- Visibility and aesthetics; Spirituality
- Habitat/community modifications
- Cost to ratepayers
- Social distrust of institutions and science
- Significant remaining risks and uncertainties

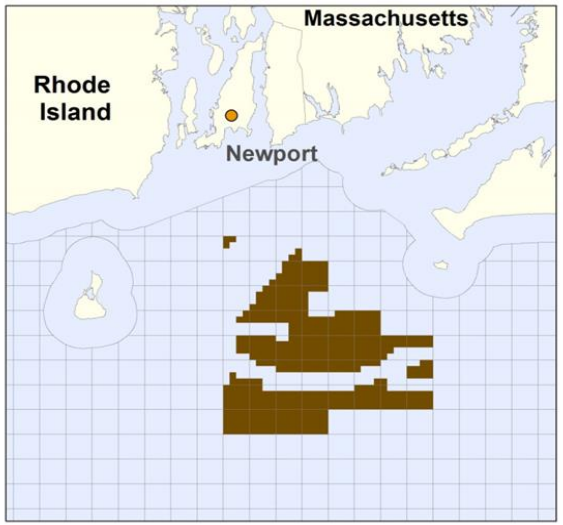


What is Social Science Research?

- Siting strategies
- Decision making – individuals and institutional
- Public perceptions
- Stakeholder engagement strategies
- Risk and uncertainty analyses
- Risk communication
- Public trust
- Equity and ethics
- Cultural context
- Sense of place, values, landscapes, seascapes, etc.

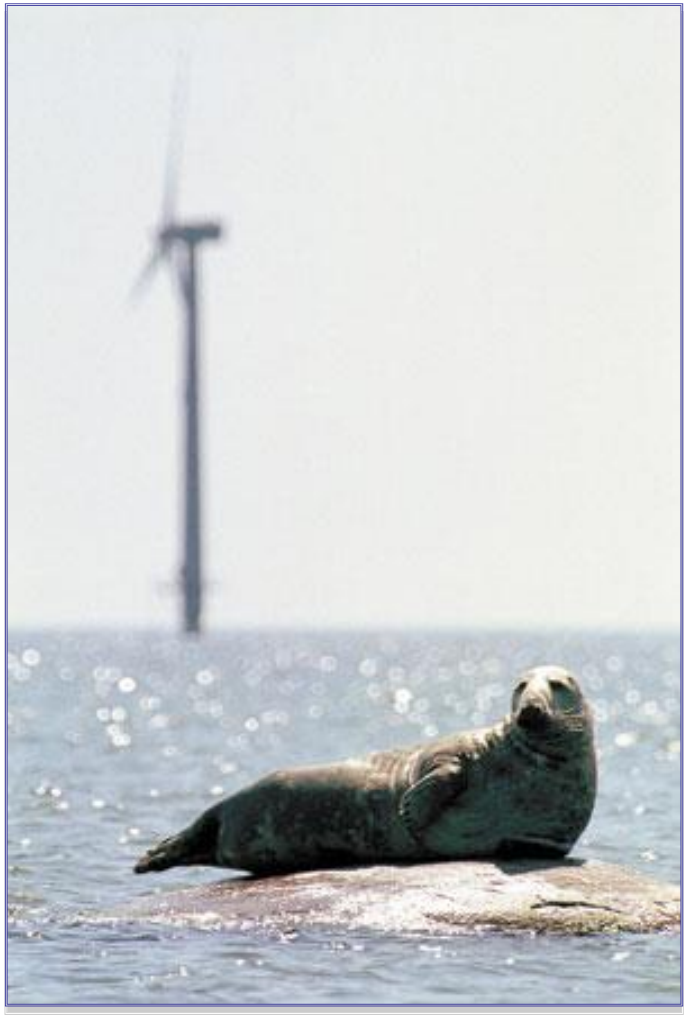
Why Integrating Social & Environmental Sciences is Needed

- Building human capacity with interdisciplinary perspectives is essential for scaling wind (e.g., Erasmus Mundus)
  - Now focus is mostly on technology/ engineering/scientific challenges, & cost reductions
  - New lexicon
- Tap into extensive social science knowledge in the US/EU (not much focus on wind to date
  - Stop talking about "NIMBY"
  - "Educate them & they will believe"
- Couple economic & cost analyses with an understanding of winners &losers



Why Integrating Social & Environmental Sciences is Needed

- Recognize risks are very local and site specific
  - "Risk du jour" approach
- More environmental monitoring due to regulatory requirements and mitigation strategies
- Public perception research may clarify true risks from perceived, e.g., wind turbine syndrome
- Little multiple-stressor or comparative perspectives



Conundrums

- Greater stakeholder participation does not always lead to better decision making
- Socio-technical approach is sorely needed for climate change scalability and regional deployments
- Beware - Length of time needed to explore social and environmental sciences
- Cultural divide or opportunities? Context is important
- Without this integrated, system pathway, we are certain to slow down or fail to scale up

Bonnie Ram
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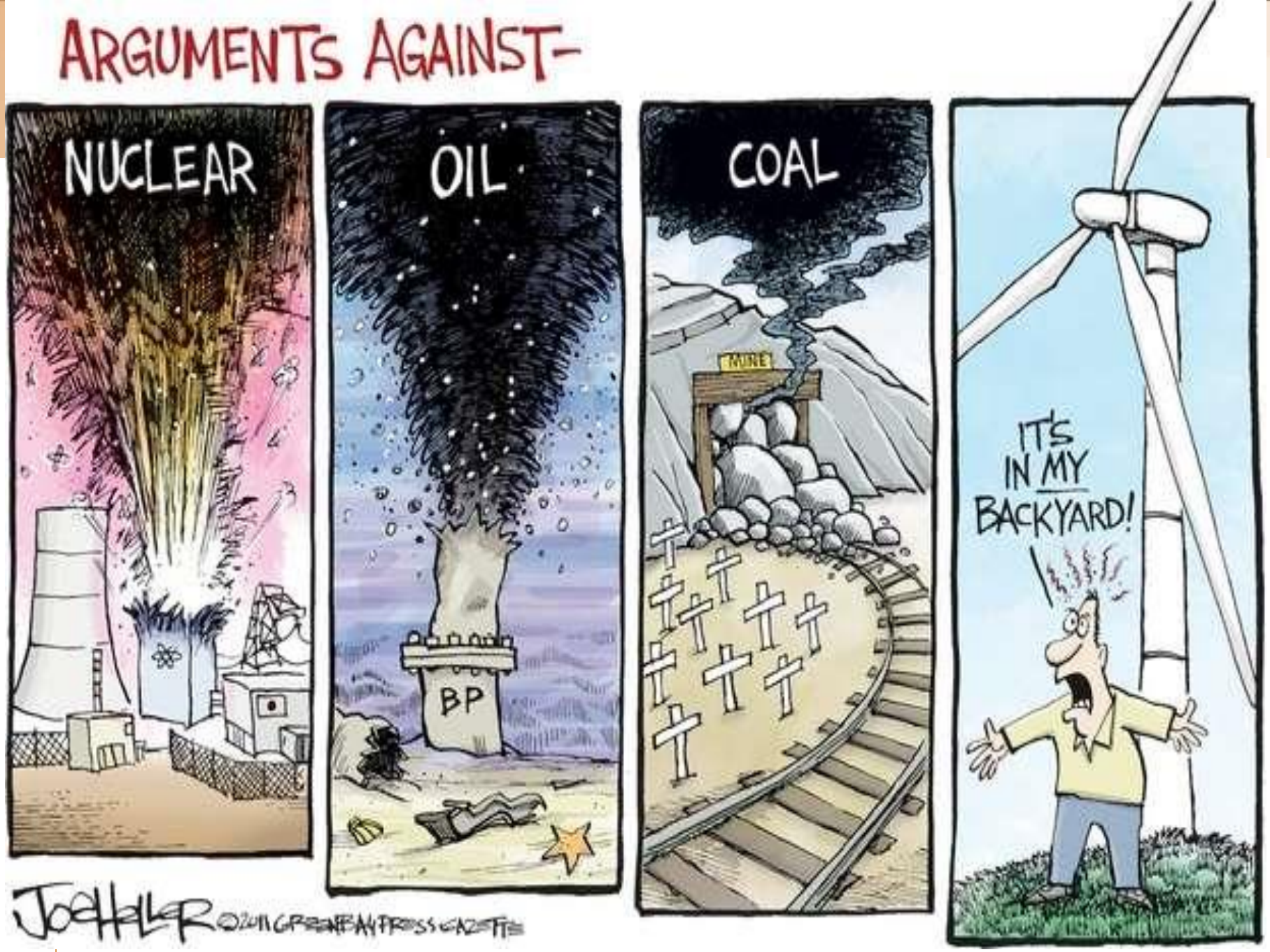
DISCUSSION QUESTION:

WHAT DOES WIND ENERGY AND SOCIETY MEAN TO YOU?

34

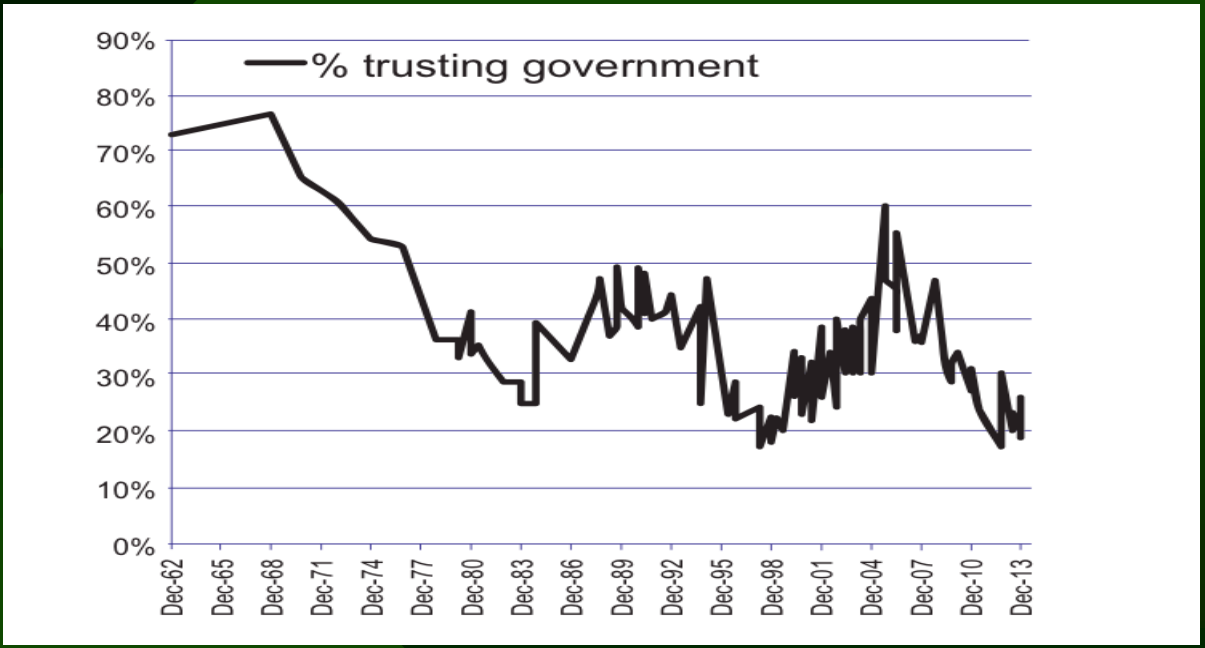
EXTRA SLIDES



http://www.hellertoon.com/main.html

GEORGE PERKINS MARSH INSTITUTE

How much of the time do you think you can trust the government in Washington to do what is right?



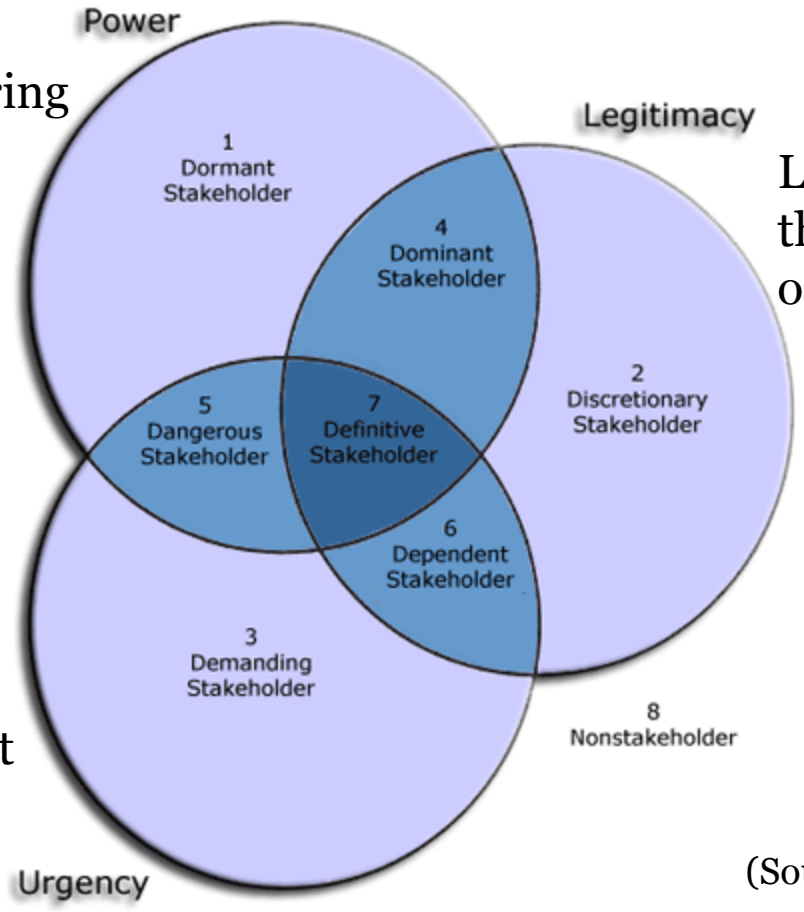
•**Trend in** Percentages shown for summed values of "just about always" and "most of the time" (other categories: Chart from: "some of the time," "never," "don't know" or "refused"). Data from: http://people-press.org/trust/. Data compiled by: Pew Research Center, National Election Studies, Gallup, ABC/Washington Post, CBS/New York Times, and CNN Polls. From 1976-2010 the trend line represents a three-survey moving average.

•Note: See BRC Technical Report. Tuler, Seth and Roger E. Kasperson (2010) SOCIAL DISTRUST: IMPLICATIONS AND RECOMMENDATION FOR SPENT NUCLEAR FUEL AND HIGH LEVEL RADIOACTIVE WASTE MANAGEMENT (BRC 29 January, 2010) http://cybercemetery.unt.edu/archive/brc/20120620221531/http://www.brc.gov/sites/default/files/documents/brc.social_trust.17feb11.pdf

•http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/102711_Kasperson.pdf

One popular framework for Stakeholder Assessment: Identifying key actors

POWER = The ability to bring about desired outcomes despite resistance



LEGITIMACY = Claims that are socially accepted or expected

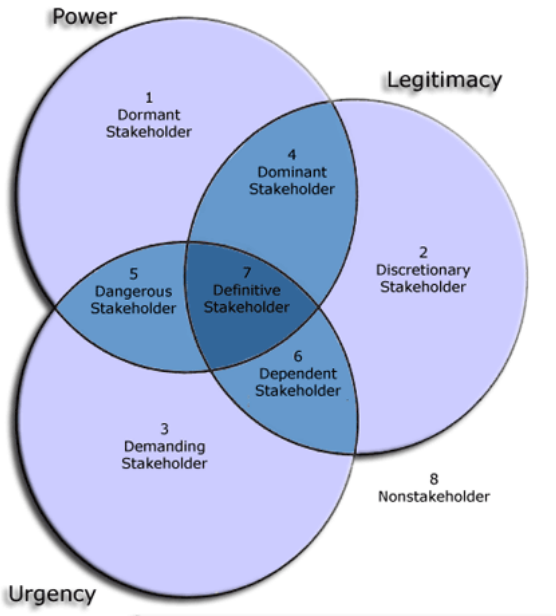
URGENCY = Claims that are time-sensitive and of critical importance

(Source: Mitchell et al. 1997)

Slide Source: Susanne Moser

A wind example

- Siting a community wind farm
  - Power:
    - Who has power over relevant decisions?
    - Who has power to block them?
  - Legitimacy:
    - Who has a legitimate claim/stake in siting community wind?
    - Pro wind/opposing wind
  - Urgency:
    - In every step of the process, who is most important to it?
    - Whose needs, decisions are first, immediate, pending etc.?
- Prioritization for engagement would be the result of overlapping criteria (P+L, P+U, L+U, P+L+U)



Slide Source: Susanne Moser

Defining Transformation:
Four Major Components

Social transformation processes involve:

(1) Structural changes to society

- ***Technology R&D***
- ***Smarter electrical grid***
- ***Institutions***

(2) Long term processes that cover at least one generation

- ***Supporting public values***
- ***National energy policies – flexible & durable***

Social transformation processes involve four major components (cont.)

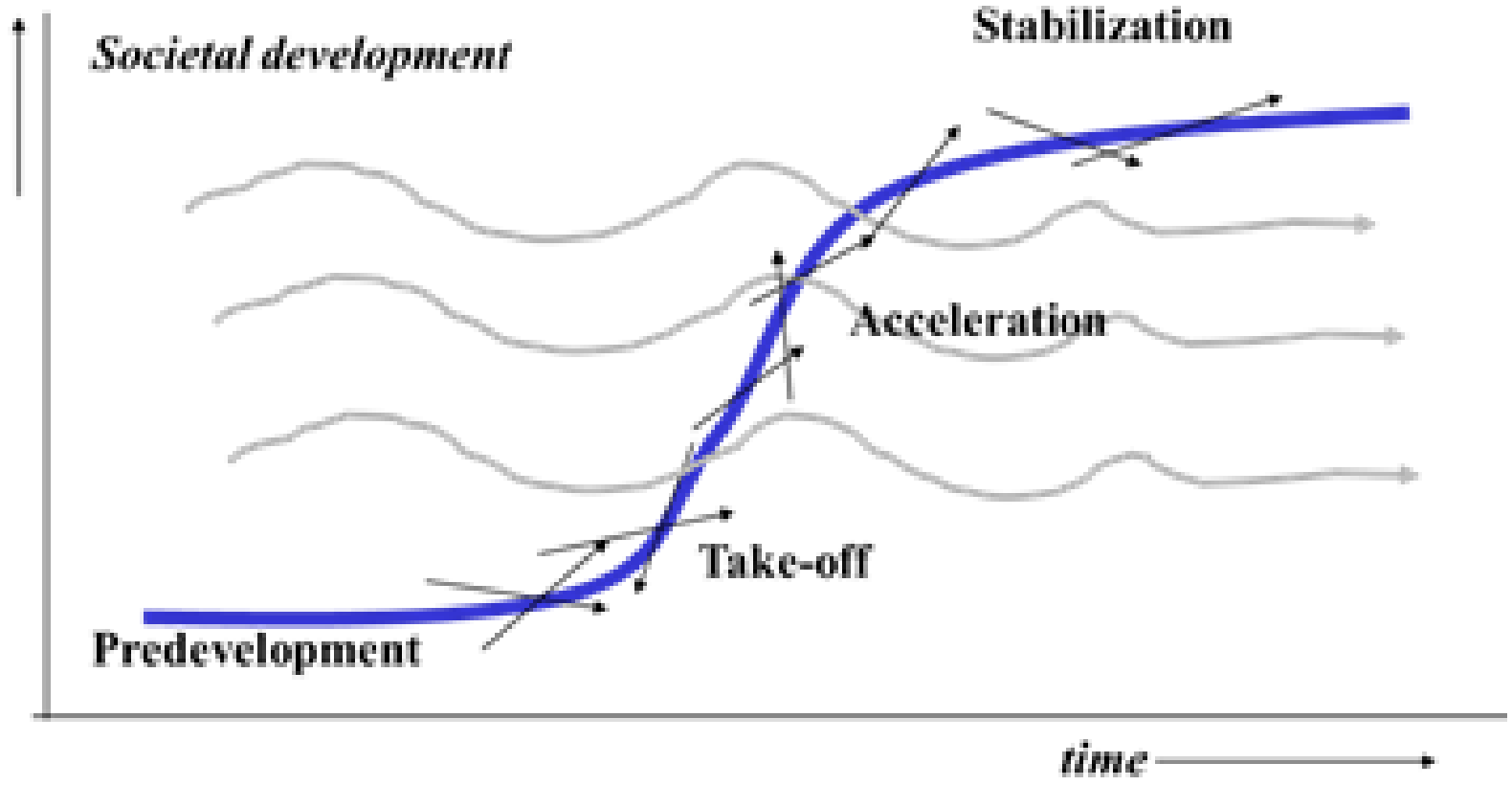
3) Large scale technological, economic, ecological, social-cultural, and institutional developments that influence and strengthen each other

- ***Subsidies***
- ***Life-cycle cost calculus***

4) Interactions between developments at different scale levels

- ***Environmental and Social risks & benefits***
- ***Risk Communication***

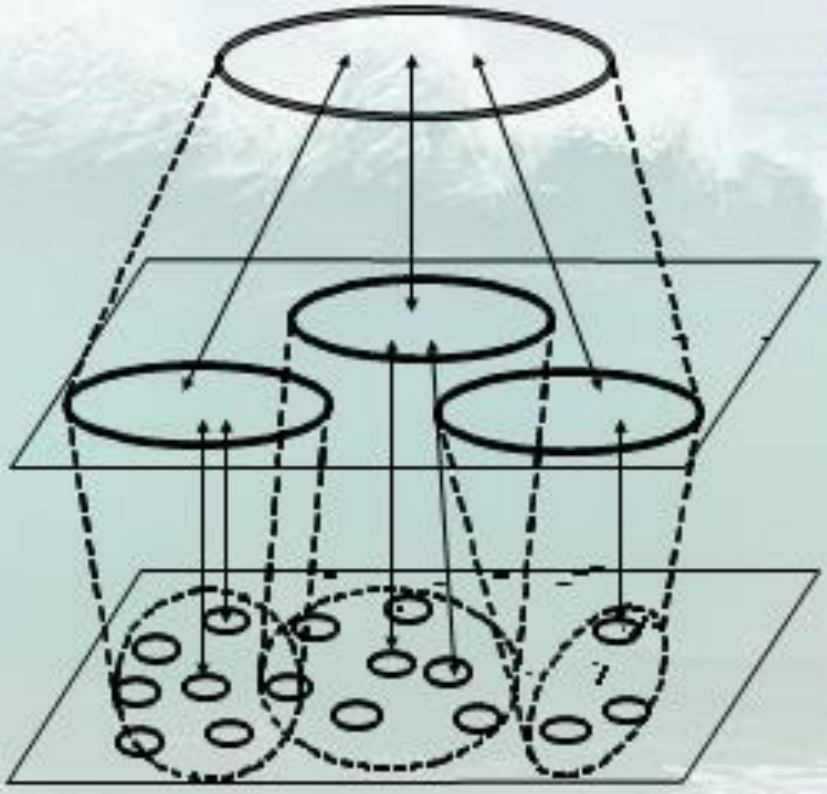
Transitions: Multi-phased



After Rotmans (2002) See http://www.transitionsnetwork.org/about www.drift.eur.nl and http://www.rsm.nl/people/jan-rotmans/publications

Transitions: Multi-Level

Transition levels



Macro-level: landscape
autonomous trends, paradigms, slow changes

Meso-level: regime
Dominant structure, culture and practices

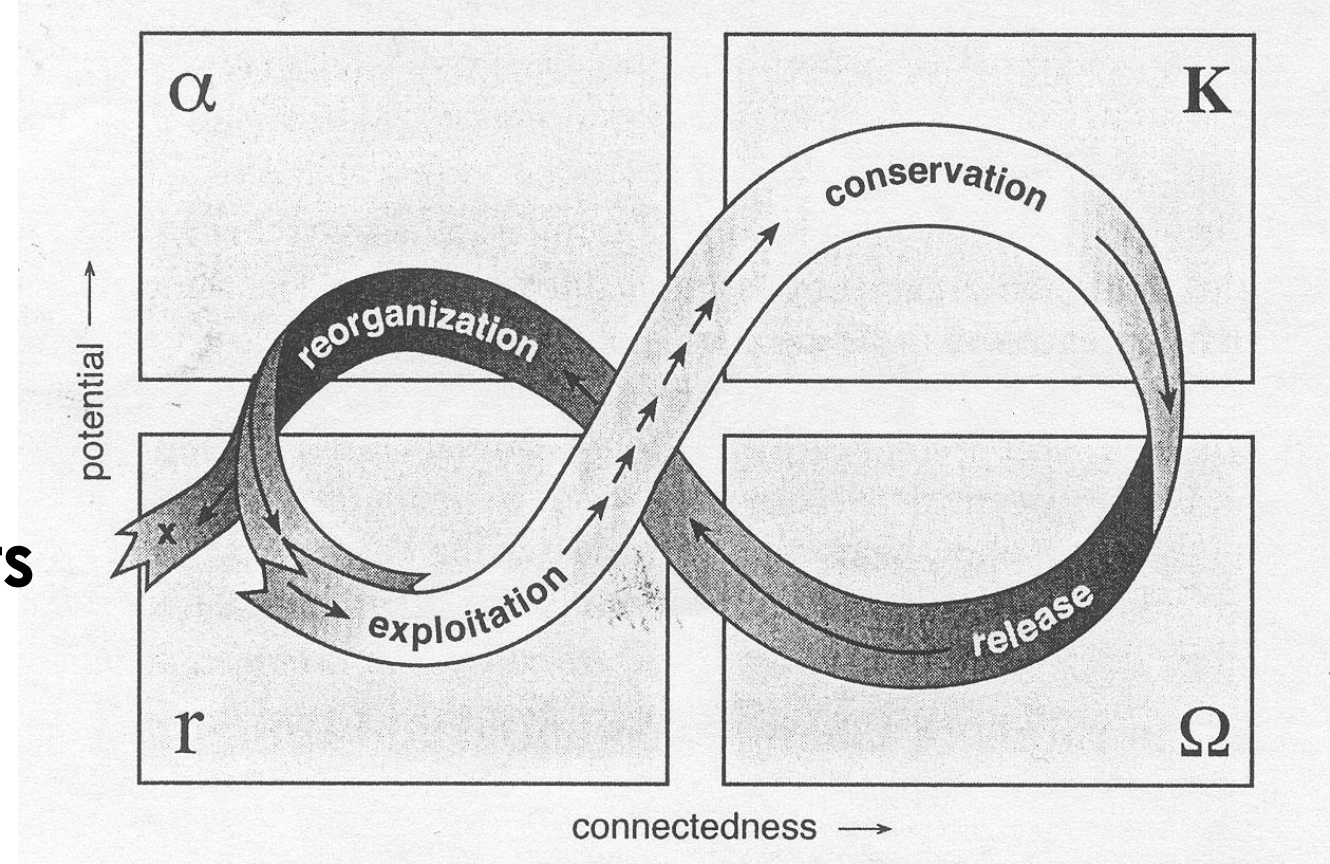
Micro-level: niches
innovative ideas, projects, technologies, niche actors

Based on Geels and Kemp, 2001

Drift Dutch Research Institute For Transitions

Multi-change Concepts

Innovation experiments with high uncertainty



L. H. Gunderson and C.K. Holling (ed.) Panarchy

Selected Current Research: USA

Universities/NGOs (selected examples)

- Mail survey work to understand public concerns, values, and attitudes, (Kempton and Firestone, University of DE)
- Decision making, risk communication, and values in energy (J. Arvai and R. Gregory)
- Policy alternatives & publics (Carnegie Mellon, G. Morgan)
- Behavioral economics and individual choices (Columbia, E. Weber)
- Smart grid and energy transformations (Clark University, J. Stevens)